

Semester Thesis

## Accurate Air Pollution Monitoring with a Smartwatch

Urban air pollution is a major concern in our modern society and, thus, monitoring air quality has received an increasing interest in the last few years. Nowadays various small and cheap environmental sensors, e.g. gas sensors that measure the concentration of pollutants, are available on the market. Their small packaging and low power consumption allows their integration into wearable devices, such as a smartwatch.

However, gathering accurate air pollution data with a smartwatch is not trivial. Multiple factors limit the accuracy of the overall monitoring system: *(i)* Low-cost gas sensors usually suffer from low selectivity, *i.e.* they are sensitive to multiple substances in the air. *(iv)* Meteorological effects, such as ambient temperature and humidity, can affect the output of low-cost sensors. *(ii)* Depending on the context of the user, *e.g.* indoors or outdoors, the air composition is completely different. Thus, the measurements also have different meanings. *(iii)* Certain pollutants are highly reactive. For instance, under certain circumstances ozone ( $O_3$ ) rapidly oxidizes with the skin of a user. Such reactions degrade the measurement quality.

**Task:** In this thesis we want to investigate those limiting factors and develop strategies to successfully compensate for them. This involves the following tasks:

- In a first part, we conduct controlled experiments that prove the existence of those effects and help us to get a better understanding. We will use a custom made smartwatch that has been equipped with different environmental sensors.
- In a second part, we develop different techniques, *i.e.* sensor calibration or context recognition, that improve the overall measurement accuracy.
- In the final part of this thesis the developed techniques are evaluated using additional experiments.



**Requirements:** Fundamental mathematical knowledge. Some experience with MATLAB or python might be beneficial, but is not required.

Interested? Please have a look at <http://www.tec.ethz.ch/research.html> and contact us for more details!

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